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Report

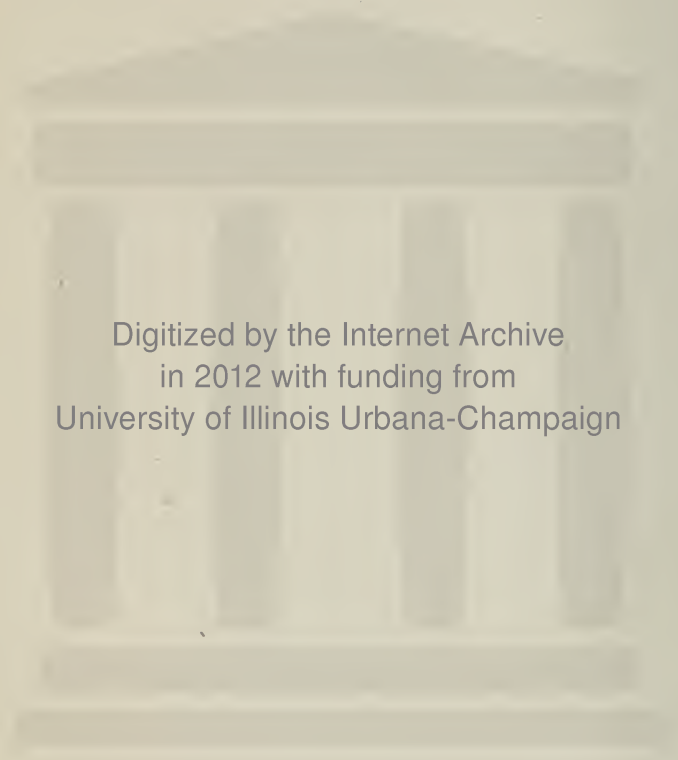
of the

Board of Regents

of the

University of Arizona.

January 1, 1901.



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January 1, 1901.

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OFFICE OF THE
BOARD OF REGENTS,
University of Arizona,

TUCSON, ARIZONA, JANUARY 1, 1901.

MEMBERS:
WILLIAM HERRING, Chancellor.
H. W. FENNER, Secretary.
JOHN H. MARTIN, Asst. Sec.
H. B. TENNEY, Treasurer.
CHAS. H. DRAKE.

EX-OFFICIO MEMBERS:
HON. N. O. MURPHY, Governor.
HON. R. L. LONG,
Supt. Public Instruction.

Hon. N. O. Murphy, Governor of the Territory of Arizona:

Dear Sir:—The Board of Regents of the University of the Territory of Arizona has the honor to present to you herewith its Annual Report for the year 1900.

In compiling this report, the Board has deemed it advisable to present to you statements in detail in relation to the different departments of the University, which have been made by the several professors directly to the Board at their request, and which are herewith incorporated as a part of this report.

Very respectfully yours,

WILLIAM HERRING, Chancellor.

H. W. FENNER, Secretary.

H. B. TENNEY, Regent.

Board of Regents of the University of Arizona.

Report of the President.

UNIVERSITY OF ARIZONA,

TUCSON, ARIZONA.

To the Honorable Board of Regents of the University of Arizona:

Gentlemen:

The departments of the University of Arizona are comprehended under the following divisions:

I. College of Agriculture and Mechanic Arts, Literary and Scientific Course, leading to the degree B. S.

Engineering and Mining Course, leading to the degree of B. S.

Agricultural Course, leading to the degree of B. Agr.

II. School of Mines.

Mining Engineering, leading to the degree B.S.(M.E).

Two year's course in Assaying.

III. Agricultural Experiment Station.

IV. Sub-Collegiate School.

High School Courses.

Manual Training School.

Domestic Science Courses.

Commercial Courses.

The condition and progress of the University during this year has been most gratifying. The work undertaken in previous years, by the various departments, has broadened in scope and grown in efficiency. The number of instructors has not been materially increased, but by compact organization it has been possible to carry on the work

with the force employed.

The department of manual training has been largely developed. A fine equipment has been provided for the carpenter's shop, and for the blacksmithing shop, and orders are being placed for an adequate equipment for the machine shop.

A small frame building known formerly as the gardener's cottage, has been suitably equipped for the use of the department of domestic science, and classes have been organized in plain sewing, in dressmaking, and in the theory and practice of cooking.

Through the generosity of the Copper Queen Mining Co., who made the University a donation of $3,000 for this special purpose, a large well-arranged brick building has been erected for the use of the manual training department. It contains three large shop rooms, a spacious draughting-room, an office, an engine room, a lavatory and tool rooms.

Courses of Study.

The courses of study are Literary and Scientific, Engineering and Mining and Agriculture. These are four year courses and in addition there is a two years' course in Assaying.

Sub-Collegiate Department.

In this department the University carried on the work of a model High School, with the advantage of the shop work and drawing of the manual training department. Students of sufficient age, who have finished the study possible to them in their home schools, may continue their preparation for college at the University under most favorable circumstances.

The splendid equipment of the scientific laboratories is available for use in this sub-collegiate work, wherever it can

be used advantageously, thus rendering strong work in elementary science possible. The instructors in this department are assisted by the professors of the college department, several of whom regularly conduct sub-collegiate classes. The school grows constantly in numbers and efficiency.

Number of Instructors, etc.

The number of persons engaged, wholly or in part, in the work of instruction and research, is twenty-one, Of these, four do no teaching, at present, but are engaged wholly in research work. Three others are employed in other capacities, but do a limited amount of teaching. Fourteen are engaged in the work of instruction:

Millard Mayhem Parker, A. M., President.

William Phipps Blake, Ph. B., A. M., Director School of Mines, Professor of Geology, Metallurgy and Mining.

Howard J. Hall, A. M., Librarian, Professor of English.

Robert Humphrey Forbes, A. M., Director Agricultural Experiment Station, Professor of Chemistry.

Sherman Mellville Woodward, A. M., Professor of Mathematics and Mechanics.

Frank Yale Adams, A. M., Commandant of Cadets Professor of History and Pedagogy.

Frank Nelson Guild, B. S., Professor Mineralogy, Associate Professor of Chemistry.

Alfred James McClatchie, M. A., Professor Agriculture and Horticulture.

David Hill Holmes, Instructor Shopwork and Drawing.

Mary E. Plimpton, A. M , Preceptress, Assistant Librarian, English and French.

Gordon H. True, B. S., Professor of Animal Husbandry, Agricultural Experiment Station.

Geo. E. P. Smith, B. S., Engineering and Surveying.

Mary Bernard Aguirre, Instructor Spanish and History.

Emma Monk Guild, Instructor Sub-Collegiate department.

Opal Le Baron McGaughey, Instructor in Physical Culture and English.

L. H. Foucar, B. A. Lit. B., Instructor in Botany, Mathematics and Ancient Languages.

Nora Towner, Stenography,

David Griffiths, Ph. D., Botanist.

William W. Skinner, B. S,, Assistant Chemist, Agricultural Experiment Station.

Mabel Grey Hoover, Instructor Domestic Science.

E. J. Hollingshead, Bookkeeping.

Attendance.

The number of students attending the University in the different years of its history is shown in the following table:—

	Graduate.	College.	Sub-Collegiate	Special.	Total Number.
1891-92		4	28		32
1892-93		22	13	3	38
1893-94		20	31	6	57
1894-95		24	21	2	47
1895-96		23	58	19	100
1896-97		22	95	34	151
1897-98	4	28	99	29	156
1898-99	1	24	82	25	133
1899-1900	5	25	104	28	161
1900-1901					est 225

By reference to the above table it will be seen that the number of students have steadily increased.

The enrollment of the present year is not completed at the time of this writing. It is considered larger than that of any previous year. Not only has the attendance increased but the grade also has steadily improved. Requirements for admission and graduation are strengthened from time to time.

Buildings and Grounds.

The University grounds comprise forty acres of land. The buildings are situated along the north and east sides of the campus, and one on the south side. Suitable roadways and paths connect the various buildings and the different parts of the grounds. Trees, shrubs, flowering plants and grass plats add beauty to the landscape and definition to roads and paths.

An unsightly barbed wire fence encloses the grounds, which, it is hoped, will soon give place to something more ornamental.

During the past year two buildings of great utility have been constructed. One, a brick dormitory, of Grecian architecture, contains forty rooms, and is occupied by the young men. The other is a shop building, mentioned above, built of brick, for the use of the Manual Training Department. It contains a power room, a drafting room, a wood-working shop, a forge shop, a machine shop, a lavatory and a model room. Each shop division provides working space for twenty-four students at benches, and space for machines and tool rooms.

Notwithstanding these additions have been made to the number of the University buildings, the institution is in sore need of more room.

The Department of Chemistry requires another laboratory. At least four more recitation rooms should be provided before September 1901.

The needs of the Library and Museum are fully set forth in the subjoined reports, to which reference is hereby made.

The boarding department demands a larger dining room and kitchen. The present crowded condition of these rooms being disagreeable in the extreme.

Athletics.

Physical training is conducted at a great disadvantage owing to the fact that the institution has no gymnasium facilities.

Athletic sports has become so important a part of college life that the absence of adequate facilities for physical training is a serious drawback to the symmetrical development of modern educational institutions.

A building and equipment adequate for present needs might well be provided as soon as funds are available.

Agricultural Experiment Station.

This department has shown marked efficiency during the year. Director Forbes has pursued a wise policy in a vigorous way. Assisted by an able staff he has been enabled to carry on investigations begun in other years and to inaugurate experimentation along lines not hitherto undertaken.

School of Mines.

The School of Mines has grown rapidly in popular favor, as its work has become known. It has outgrown the space alloted to it, and stands in pressing need of another laboratory.

The work of the various departments is fully set forth in the reports herewith submitted.

Statement of Morrill Fund.

Ending June 30th, 1900.

Balance on hand July 1st, 1899	$11,553.82
Receipts by the Government	25,000.00
Total	$36,553.82
Disbursements for the year	$27,261.89
Balance	$ 9,291.93

Expenditures from June 30, 1899, to June 30, 1900.

AGRICULTURE AND MECHANIC ARTS.

Salaries of Instructors	$ 3,370.50
Text Books and Reference Books	88.62
Apparatus, Machinery, etc	3,077.28
Total	$ 6,536.40

ENGLISH LANGUAGE.

Salaries of Instructors	$ 6,073.66
Text Books, Reference Books	977.43
Apparatus, Machinery, etc	254.76
Total	$ 7,305.85

MATHEMATICAL SCIENCE.

Salaries of Instructors	$ 2,190.00
Books	4.84
Apparatus, Material, etc	3.00
Total	$ 2,197.84

NATURAL OR PHYSICAL SCIENCE.

Salaries of Instructors	$ 5,835.27
Books	265.69
Apparatus, Machinery, etc	853.12
Total	$ 6,954.08

ECONOMIC SCIENCE.

Salaries of Instructors	$ 3.726.67
Books	103.44
Apparatus, Machinery, etc	437.61
Total	4,267.72
Total Disbursements for the year	$27,261.89

TERRITORIAL FUND.

Year 1900.

Receipts		$12,340.75
Disbursements for the year		
Salaries	$1,520.00	
Labor	2,214.97	
Per Diem and Mileage of Regents	200.00	
Printing and Stationery	296.71	
Material and Supplies	1,276.89	
Fuel, light and water	565.90	
Furniture and fixtures	1,039.70	
Building and repairs	4,115.03	
Apparatus	75.90	
Library	18.00	
Contingent	1,017.65	$12,340.75

CONTINGENT

Receipts	$2,600.52
Disbursements	2,481.26
Balance	119.27

M. M. PARKER,
President.

Report of Department of Mineralogy and Chemistry.

UNIVERSITY OF ARIZONA,

TUCSON, ARIZ., DEC. 5, 1900.

President M. M. PARKER,

Dear Sir:—

The following is a report of the student work in the Department of Mineralogy and Chemistry for the year ending Dec. 31st, 1900:

Mineralogy is taught for two-thirds of a school year, about six months, and consists in two lectures a week in Crystallography and Classification of minerals, and six hours per week of labratory practice in Blow-pipe Analysis and Determinative Mineralogy. Although six hours only are required, the average student usually spends nearly double that time. Each student is expected to determine from 150 to 200 varieties of minerals by actual blow-pipe analysis; and to become familiar with a type collection of minerals, recently added to the museum, consisting of 600 varieties. Thus it is hoped that the students after completing this

course will be able to recognize readily any mineral he may meet. The Department is especially in need of apparatus for preparing polished specimens of minerals and thin sections of rocks for the study of Lithology and Petrology.

During the school year 1899-1900, the class in Mineralogy consisted of four members, two of whom were post-graduate students. During the present school year, the class consists of six members all from the Junior class.

General Chemistry is taught during one-half year, and consists of from three to four lectures per week with four or more hours of laboratory practice. This is followed the second half year by not less than ten hours per week of labratory practice in Qualitative Analysis. At the end of the year the student is expected to be able to determine by chemical analysis, the nature of almost any common substance.

During the year 1899-1900, the class consisted of about twenty-two members, about eight of whom, however, dropped out before the year ended. During the present year, the class consisted of seventeen members belonging, for the most part, to the Sophomore Class.

The Course in Quantitive Analysis is a ten-hour per week course, and consists almost entirely in laboratory work. During the present year there are nine students taking this course, eight of whom rank as Juniors and one as Senior. Following is quite a complete outline of work being done by the students this year in this department:

Analysis of iron wire, determination of Chromium in Potassium Chromate, Complete Analysis of iron ore, Limestone, Dolomite, Glass, Garnet, Magnetite, Galena and Brass.

The Volumetric Assay of Silver Bullion, and the Volumetric Determination of all the common metals.

The course in Fire Assaying is offered during the spring term of the Junior year, and consists in practice in the use of both the coke and gasoline assay furnaces. During the past year the class consisted of four students. In this course the students make about twenty assays for lead by the fire method, and 100 assays in duplicate for gold and silver. Several assays of gold and silver bullion are also conducted by the student.

The course in Metallurgical Chemistry is offered during the Senior year and consists especially in considering in the laboratory those chemical problems, a thorough understanding of which is necessary in the treatment of ores on a large scale. Following is an outline of the work actually conducted by the students during the present year:

Complete analysis of coke, slags, mattes, etc., the treatment of tailings by the cyanide process, and gas analysis.

During 1899-1900 there were four taking this course all of whom are now holding good positions in some metallurgical plant. At present there are three in the course, one a Senior in the University and the other two special students in the School of Mines.

The work as outlined above is conducted by one member of the faculty, who is professor of Mineralogy and Analytical Chemistry and Associate professor in General Chemistry, assisted by two of the students, one taken from the Senior class and the other from the Freshmen class. The Senior assistant's duties consist in preparing apparatus for the chemical lecture table, in preparing the chemicals and reagents for student use, and in keeping the chemical store room and general apparatus in order. At times also he is called upon to assist in instructing in general Chemistry. The other assistant is occupied chiefly in janitor work about the laboratory and in grinding samples for analysis.

The work of the Departments is very much hindered for the lack of room, there being seventeen in General Chemistry with room to accommodate only about one-half that number. Recently the assay furnaces have been removed from the main building to give more room for Analytical Chemistry, as well as for purposes of safety, leaving the department without an available room in which to teach Fire Assaying. It is hoped that this deficiency will be met before the spring term opens, when there will be a class of about nine taking the subject.

Respectfully,

F. N. Guild.

Annual Report of Teaching in the Department of Mathematics and Physical Science.

UNIVERSITY OF ARIZONA,

TUCSON, ARIZONA, Dec. 3, 1900.

A.—MATHEMATICS, PURE AND APPLIED.

First Sub-collegiate Class. Arithmetic taught by Mrs. Guild to a class of forty-five.

Second Sub-collegiate Class. Arithmetic during half the year, Elementary Algebra during the remainder of the year, taught by Mrs Guild to a class of thirty.

Third Sub-collegiate class. Elementary Algebra taught by Mrs. Guild to a class of forty.

Fourth Sub-collegiate Class. Plain Geometry, taught by Miss Foucar to a class of twenty.

Freshman Class. Higher Algebra for two-thirds of the year, taught by myself to a class of eight.

Freshman and Sophomore Classes together. Trigonometry for one-third of the year, taught by myself to a class of sixteen. On account of the smallness of our teaching force, trigonometry is taught only every second year and

hence the freshman and sophomore classes take the subject together.

Sophomore Class. Analytic Geometry for two-thirds of the year, taught last year by myself, and this year by Prof. Smith to a class of eight.

Junior Class. Differential and Integral Calculus taught by myself to a class of two.

Senior Class. Analytic Mechanics, taught by myself to a class of two. This subject includes statics, dynamics, graphic statics, study and riveted joints, strength of beams, columns, hydrostatics, kinematics, study of the steam engine.

Sophomore class. Surveying taught by Professor Smith to a class of sixteen. On account of the smallness of our teaming force this subject is taught only every second year. The subject includes a study of the care, adjustment, and use of chains and tapes, compasses, levels and transits, the observations and occupations of lands, railroad, irrigation and mine surveying. The students go through all the surveyor's operations with the actual insruments in the field and make the resulting calculations and plats.

Senior class. Structural Engineering, taught by Prof. Smith to a class of two. This subject covers the design of masonry structures, such as dams, piers, and arches, the manufacture, testing and use of materials of construction such as stone, cement, timber, iron, steel and other metals, the theory of hydraulics and hydraulic machinery.

Senior class. Logic, inductive and deductive, taught for one-half of last year by myself to a class of four. On account of the smallness of our teaching force this subject is taught only every second year and will not be taught this year.

B.—Physical Science.

Second Sub-Collegiate class. General Elementary Science, taught by myself to a class of thirty-five. It is the aim of this work to introduce the student to general methods of laboratory work, to give him a rudimentary knowledge of the various sciences so that he may intelligently make a choice of studies to be pursued later in the course, to teach him to observe accurately, to compare impartially and critically, to reason carefully and logically, and above all to state all his observations and conclusions in clear and grammatical english.

Fourth Sub-Collegiate class. Elementary Physics, taught last year by Prof. Tyler and this year by Prof. Smith, to a class of eight.

Respectfully submitted,

S. M. Woodward,

Professor of Mathematics and Mechanics.

Report of the English Work in the University and Sub-Collegiate Department.

President MILLARD M. PARKER,
UNIVERSITY OF ARIZONA,
TUCSON, ARIZONA.

Dear Sir:—

I have the honor to submit the following report of the English work done in the University and in the Sub-Collegiate department:

This report has been prepared by Miss Mary E. Plimpton, Associate Professor of English, and myself. Miss Plimpton has prepared the parts concerning the Sophomore English and that of the first, second and third year sub-collegiates. I have prepared the parts concerning the Freshman and Junior work and the fourth year sub-collegiate.

The following table shows the distribution of the English work:

University.

Howard J. Hall, Professor of English, Freshman English, 5 hours per week.

Howard J. Hall, Professor of English, Junior English, 5 hours per week.

Mary E. Plimpton, Assistant Prof. English, Sophomore English, 5 hours per week.

Sub-Collegiate.

Howard J. Hall, Professor of English, fourth year, 3 hours per week.

Mary E. Plimpton, Associate Prof. of English, third year, 2 hours per week.

Emma M. Guild, Instructor Sub-Coll. Dept., second year, 5 hours per week.

Opal L. B. McGaughey, Instructor Sub-Coll. Dep., first year, 5 hours per week.

University English.

The English of the Freshman year occupies five hours each week through both semesters. The work consists in the reading, interpretation and criticism of the leading writers of English prose of the nineteenth century. Macauley, Carlyle and DeQuincy are studied most carefully as a basis. Other writers of prose are taken up during the latter half of the year, when a larger amount of reading will be done outside of class. No text book is used in class, but instruction is given by means of discussion and lectures.

The English of the Sophomore year occupies five hours each week throughout the year. The texts used are, Genung's Practical Rhetoric and Rhetorical Analysis and Baker's Specimens of Argumentation.

The course aims to further a more mature command of written English and of the power of thought, to make the student familiar with the principles of description, narration, exposition, argumentation and pursuasion, and with the various types of literature, embodying these kinds of composition. Practice in the different kinds of writing is made the first design of the work, such practice intended to add as much to the student's appreciation of literature as to the development of his ability to write well.

The English of the Junior year is conducted in much the same manner as that of the Freshman year, though more thorough work is required. A close study is made of a few of Shakespeare's plays and of Milton's more important poetry. A more rapid study is made of nineteenth century poets, including Tennyson, Browning and Arnold.

Throughout the years occupied by the English work there are frequent papers written by students on themes directly connected with the study of the authors.

The work of public rhetoricals also devolves upon the English department, one essay or speech each term being required of each student taking English in the University or taking any course leading to a degree.

The English of the first sub-collegiate year occupies five hours a week throughout the year. The work comprises:

I. Whitney and Lockwood's Grammar.

The grammar is studied in a systematic manner. The aim is to give the student a thorough acquaintance with the principles of the language. Much attention is given to analysing and parsing, and to practice in the writing of simple paragraphs.

II. Evangeline. III. Lady of the Lake. IV. Alhambra.

The work calls for a close study of the subject matter, the memorizing of selected passages, outlining of portions, and writing of character sketches and compositions on topics selected from the outlines.

The English of the second year, sub-collegiate, occupies five hours a week throughout the year.

The texts used are:

I. Whitney's Grammar (finished and reviewed).

II. Snowbound. III. Sir Roger de Coverley Papers. IV. Ivanhoe.

Much of the same method of study is followed as in the first year.

The English of the third sub-collegiate year occupies two hours a week throughout the year. The work covers:

I. Lockwood's Lessons in English.

This comprises a study of words in their history, meaning and use, figures of speech, effective construction of sentences, paragraphs and entire composition. The frequent practice in writing is designed to promote accuracy in spelling, punctuation, division into paragraphs, and power of expression in clear, correct and forcible English.

II. Vision of Sir Lunfal.

Special attention is given to the aids to Elegande, to the nature scenes, the contrasts, and to the thought and application of the poem. Portions are memorized, paraphrases written and themes based on the study required.

III. Bunker Hill Monument Oration.

Complete outlines are required of each lesson assigned; results are read and criticized in class.

Definitions of words, and explanations of allusions, historical and political are given, and the prominent elements and qualities of style discussed.

IV. Style. From Milton to Tennyson. Twelve selected poems.

The method of study for each poem is as follows: 1. Investigation of the life and times of the author. 2. Outline of the arguments or narrative of the poem, 3. Memorizing the selections. 4. Explanation of obsolete or unusual words and constructions. 5. Study of rythm, meter, figures of speech, etc. 6. Paraphrases of more difficult passages. 7. Essays on the style and thought of the poems.

The fourth year English consists in the study of elementary rhetoric and of selected classics. The text book used is Genung's Outlines of Rhetoric. Frequent written exercises are required of the students, which after being corrected are criticised in class. The classics studied are Merchant af Venice, Julius Caesar, Macaulay's Warren Hasting's and George Eliot's Silas Warner.

Very respectfully submitted,

HOWARD J. HALL,

University, Dec. 4, 1900.

Report of Department of History, Political Science and Pedagogy.

UNIVERSITY OF ARIZONA,

TUCSON, ARIZONA, Dec. 4, 1900

M. M. PARKER, A. M.

President of University of Arizona.

Sir:—I have the honor to submit the following report of the work of the department of History, Political Science and Pedagogy during the year 1900.

From January to June I instructed classes in the Collegiate department as follows: History of England, 6; Political Economy, 8; Psychology, History of Education and Pedagogy, 4. In English History, the class completed Green's Shorter History of England with much supplementary reading. In Political Economy the class completed Walker's Advanced Political Economy with a large amount of assigned reading on special topics; the latter part of the year was devoted to the investigation of special topics, such as the tariff, bimetallism, etc. Each member of the class prepared an original theses on some topic connected with the subject. The instruction in Pedagogy and History of Education was

given chiefly by means of lectures and assigned reading.

During the same time I instructed classes in the Sub-Collegiate department as follows. In General History 16; in Civics, 21. The class in General History used Adam's European History with assigned reading. The class in Civics used Fisk's Civil Government with practical questions and debates. All of my classes used, as far as our material would permit, the laboratory method of instruction.

Besides the above, I met the two highest Sub-Collegiate classes once each week for instruction in Parliamentary Practice and debate. The classes were organized after the plan of an assembly. The aim of this work was to give the students practice in parliamentary procedure and in presiding in meetings, also in debate, both ex-tempore and prepared.

Between September and the present date I have instructed classes in the same subjects as given above with the addition of a class for the Juniors and Seniors in American Constitutional History. The work in this course is given in the form of lectures and seminary work and is designed to give a general knowledge of the growth of our constitutional government from the time of the settlement of the colonies.

During the year about $200 worth of books and two sets of historical maps have been added to the equipment of this department. We are still hampered by the lack of books and maps, for the laboratory in this department consists entirely of books and maps.

All of which is respectfully submitted,

F. YALE ADAMS,
Professor of History and Pedagogy.

Report of Military Department.

UNIVERSITY OF ARIZONA,

TUCSON, ARIZONA, Dec. 5, 1900.

M. M. PARKER, A. M.,

President University of Arizona.

Sir:—I have the honor to submit the following report of the work of the Military Department for the year 1900:

From January to June I was ably assisted by Mr. Charles P. Richmond of the Senior class who acted as Military instructor and discharged the duties assigned to him in a very satisfactory manner. The male students are organized into one company and the officers appointed as the result of a competitive examination. The company consisted of fourteen officers and fifty privates. In May the members of the company competed for a gold medal offered by Mariner's Juvenile Orchestra for the best drilled cadet. This medal was won by private Tom Trevillian. During commencement week in June the faculty offered a gold medal to be competed for each year. This was won by Corporal George Martin.

Since September 1st, I have acted as Military instructor. The cadets are organized into a battallion of two companies.

The officers were appointed as a result of a competitive examination. There are at present four staff officers, twelve officers and men in company A, Capt. Rudolph Castaneda commanding; twelve officers and thirty-four men in company B, Capt. Geo. M. Parker commanding.

During the year we received from the territory the loan of fifty 45-calibre Springfield rifles with bayonets, belts and cartridge boxes. These were sufficient to arm the one company and greatly increased its efficiency. This term we are obliged to arm company B, with the old 50-calibre rifles greatly to the detriment of its appearance and its efficiency. We greatly need seventy-five more of the 45-calibre rifles, also a stand of colors.

It is my intention to organize a Signal Corps during the present month, with Capt. E. H. Andrews in charge.

I have also acted as Governor of the men's dormitory during the year. There are at present rooming in the dormitory sixty-six students and two instructors.

I would respectfully call attention to the need for piping for water and a sink on the upper floor of the dormitory, and also of some adequate means for heating water for baths during the winter months. The present method of lighting the building by means of coal oil is very unsatisfactory, and, to my mind, dangerous.

I have the honor to be
Your obedient servant,
F. YALE ADAMS,
Lt. Col. N. G. A. Commandant.

Librarian's Report.

UNIVERSITY OF ARIZONA,

TUCSON, ARIZONA.

President MILLARD M. PARKER,

Sir:—I have the honor to make the following report of the condition and needs of the University Library on December, 1900, adding thereto such other information as is naturally connected with a report of this department:

Bound volumes, catalogued	4713
" not catalogued, consisting mostly of Government Reports	467
Unbound volumes, periodicals	210
Total	5390
Pamphlets and unbound reports, estimated	10000
Total cost to University of bound volumes	$8,026.92
" " of periodicals unbound	315.00
Total value of gifts (estimated) not including government reports—	
Books $100	
Pictures 60—	160 00

Total value of fixtures—		
Catalogues	$300	
Tables	60	
Cases	220	
Desks	20	
Miscellaneous	25—	625 00

Total value of library, not including pamphlets and government reports,

The sum of one thousand dollars, which according to established custom has been appropriated annually for the purchase of books, periodicals and bindings, has up to the last two years been sufficient for the growing needs of the Library. Last year an extra amount of $500, appropriated from the Morrill fund, met the demands upon the Library, caused by the increased attendance of students. This year the thousand dollars is insufficient to allow the Library to keep pace with the other departments of the institution, or to supply the demands made upon it by instructors and advanced students. We must have more money if the library is to fill its natural place in an institution of well balanced equipment.

I take the present occasion to call again to your attention the urgent needs of the Library for more room and for quarters less in danger from fires.

At the beginning of the present school year it seemed impossible that the Library could continue longer in its present crowded quarters. In considering the proposition of enlarging the Library by removing the partition between it and the English Class-room, we found that there were no rooms in the building where English Classes might be held if the present class rooms were done away with. We were then forced to re-arrange totally the Library room, filling up

our already crowded space till the cases now stand from sixteen to twenty-six inches apart. Even this crowding leaves the reading room less than twenty feet square, and since this room is used by all University Students as a study room in vacant hours, no farther comment upon the narrowness of space is necessary.

The risk to the Library from fire is not lessened as the years go by. The main University building which houses the Library, is constructed of inflammable material and is exposed to such menacing conditions as are constantly present in the chemical laboratories, in the heating of the building by eighteen stoves, in the use of kerosene lamps and in the imperfect wiring of the electric light system. I am informed that last year an incipient blaze caused by defective wiring was discovered in the room immediately beneath the Library, but fortunately was put out before any damage was done. Furthermore the fire apparatus of the building seems quite insufficient even for slight emergencies.

The Library has reached such a stage of growth that its loss would be almost irreparable to the institution. I will mention one case only in illustration. We purchased last year the North American Review complete from 1815. This set, so far as we could find, was the only set on sale in the United States, and came partly from the library of the famous book collector, George Brinley. If this set were lost, so rare has the periodical become, that even if we could again collect it, the expense to us would be far beyond the original cost of $312. This periodical is only one of several that we have completed, others going back from twenty to sixty years, and constantly increasing in value.

With the sanction of yourself, I have procured preliminary plans of and estimates on the cost of a Library building, such as our necessities here demand. It is found that a

handsome and substantial stone and iron structure, housing the Library, the Museum, the administrative offices of the President of the University, and the Board of Regents, together with the offices of the Director of the School of Mines, and containing two special class rooms, could be built for the sum of $30,000. This would be a practically fire-proof structure.

The use of the Library is constantly increasing. From October 1st to December 1st, 440 volumes were drawn out by students and instructors, not counting the reserved and reference books in constant daily use in the reading room.

Owing to the re-arrangement of the stacks made necessary by the crowded condition, almost the entire time of the librarian and the assistant librarian from the beginning of the school year up to date, has been consumed in handling, assorting and replacing the books and pamphlets. We are now ready to begin a further extension of the system of classification, and we hope to reduce the Library as speedily as possible to the same system used in the majority of libraries in this country. In order to carry out this work we shall need some fifty dollars to be expended before June next in Library fixtures.

At present the library is open to students from 8:30 A. M. to 4:30 P. M. on school days and it requires the constant presence of the librarian or the assistant librarian during that time, except during the forty minutes recess for luncheon. On Saturday it is open seven and one-half hours, a student assistant taking charge on these last two days except for Saturday afternoons.

Very respectfully submitted,

HOWARD J. HALL, Librarian.

University, December 1, 1900.

Report of Department of Manual Training.

UNIVERSITY OF ARIZONA,

TUCSON, ARIZONA, Dec. 3, 1900.

To M. M. PARKER,

President of University of Arizona.

Dear Sir :—

I have the honor to present herewith a general report of the Department of Manual Training of the University of Arizona.

Manual Training occupies so prominent a place among subjects taught in preparatory schools and universities, and its many distinctive features are so universally recognized, that it is unnecessary to enter into details here.

DRAWING AND SHOP WORK.

In Manual Training there must always be the two divisions, drawing and shop work, the representation of the object, and the manufacture of the material object. In practice we invariably find the draughting room connected with the shop.

HISTORICAL.

1898.

When the writer was employed two years ago, to develop the Manual Training Department, there were few facilities for instruction in either drawing or shop work and the student had no knowledge of either subject. To teach Manual Training properly requires good work rooms and a variety of expensive tools, machines and other shop fittings. Drawing requires far less in the way of equipment than Shop Work, hence it was natural that the first year should be devoted mainly to instruction in various kinds of drawing. Several classes were organized for instructions in Free-hand Drawing, Mechanical Draughting, and Descriptive Geometry, and one small class in Bench Work in Wood.

FIRST YEAR RESULTS.

At the end of the first year the shop had a floor area of 700 sq. ft., it contained eight work benches, a dozen sets of bench tools, a small engine, four wood lathes and a half dozen sets of lathe tools. It was possible to make a fair exhibition of drawing at the close of the year. The exhibition of Shop Work was confined to simple exercises and two benches in which the framing of the joints had been performed by the student.

1899.

The second year (last year), the shop area was increased to 1600 sq. ft, (but this was only a temporary arrangement). A grindstone and universal wood-worker were added to the equipment and a complete assortment of bench tools for thirty-six additional students was purchased.

SECOND YEAR RESULTS.

Forty-eight students divided into three sections were

instructed in wood-work and mechanical draughting. Besides a class of fifteen girls was given lessons in free-hand sketching and a class of Sophomores, instruction in Descriptive Geometry. Shop students at the close of the year were designing and making such articles as picture frames, printing frames, tables, desks, mineral cabinets and like things. The mechanical draughting was confined to such articles as the students made in the shop.

DESCRIPTIVE.

NEW MANUAL TRAINING BUILDING 1900.

In September of the present year the new Manual Training Building was begun, and on November 9th all classes in Drawing and Shop Work moved into their new quarters.

Following is a description of the new building:

MANUAL TRAINING BUILDING.

The total floor area of the new building is 7,600 square feet. This is divided as follows:

SHOP AREAS.

Power Room	1,200
Draughting Room	1,200
Wood Working Shop	1,400
Forage Shop	1,400
Machine Shop	1,400
Wash Room	600
Model Room	400

WORKING SPACE.

Each Shop division provides working space for twenty-four students at benches, and ample space for machines and tool room.

The Draughting Room accommodates from thirty-six to forty-eight students.

USE OF OLD SHOP.

About 300 square feet of the old shop remains for storage of materials and finished exercises. The other portion of the old shop has been turned over to the Assay Department.

LIGHT AND VENTILATION.

Light and Ventilation are well provided for by means of continuous rows of sash in the North slopes of the saw tooth roof construction. A constant circulation of fresh air is thus assured, also an ample supply of diffused North Light, and incidentally the hot rays of the sun in the fall and spring months are excluded.

HEAT.

The Draughting Room at the time of this writing is heated by steam from the Boiler House.

WOOD WORKING DIVISION OF THE SHOP.

EQUIPMENT — POWER ROOM, ENGINE, EXHAUSTER AND BLOWER.

The Power Room will contain one 11x14 Atlas Plain Self-Contained Engine, 35 horse power. This engine has been purchased and is expected to arrive any day. A 70 degree Sturtevant Exhauster and a No. 3 Blower are located in this room. A 16 horse power Westinghouse Engine and Dynamo are also in this room. The Dynamo is used to light the main building, but may also be used in connection with the shop.

DRAUGHTING ROOM.

The Draughting Room contains: 12 large draughting tables, 12 Laughlin-Hough patent drawing tables, 48 drawing boards, 18 free-hand drawing desks and chairs.

CARPENTER SHOP.

The Carpenter Shop contains: 24 each—work benches, vises, bench stops, hammers, jack planes, smooth planes, rabbet planes, braces, T-bevels, marking gauges, try-squares, cross cut saws, rip saws, back saws, dividers, nail sets.

12 each—Oilers, oil stones, bench brushes, mallets, spoke shaves, scratch awls, files, jointer planes, mortise gauges.

Full assortment of special tools, of which there are only one or two of a kind: 46 individual plane irons and caps, in two sizes; 48 individual sets of 7 chisels and 2 gouges, 24 sets augur bits, 5 sizes in each; 24 sets carving tools, 10 tools in each; 24 sets wood turning tools, 10 tools in each.

FORGE SHOP.

The Forge Shop contains: 24 down draught forges. 24 each, anvels, hardies, tongs and hammers. Full assortment swedges, fullers, flatters, heading tools, hot and cold chisels and sledges.

MACHINE SHOP.

The Machine Shop contains: Only two 14 deg. engine lathes. A No 2 Brown and Sharpe universal milling machine has been ordered

WASH ROOM.

Ninety lockers are being made for the Wash Room and will be in place in a fortnight.

VALUE.

The approximate cost of the building to date is $5,000, and the cost of the equipment, $5,000.

METHODS OF TEACHING.

IMPORTANCE OF DRAWING.

Shop exercises are generally made from drawings of the object, hence it is necessary that the student should be taught first to understand and interpret drawings.

It has been the custom to require of the student a good drawing of every object after it is made and before the new exercise is commenced. The student has little difficulty in representing the object correctly, as he has a thorough understanding of its construction, and all his attention can be given to the neat and accurate finish of the drawing.

Students are encouraged to apply the knowledge gained in any exercise to the design of original work. In such cases the drawing must be made first.

In all work the care and use of tools is taught first, also the theory with regard to the action of any particular tool.

The steps in the preparation of the material from the crude original form to its finished form are next taught.

A grand series of exercises illustrating the various steps and process is executed by each student, and as soon as practicable these exercises are made to assume the form of common objects of utility. This method appeals with force to the student's mind and increases his interest in his work.

When the fundamental principles have been fully mastered, attention is directed to the design of original and difficult work

A student on completing the Manual Training course, should have such a general knowledge of the Mechanic Arts

that he could obtain a fair salary as draughtsman or designer.

The advanced work in the Machine Shop is essential in the Mechanical, Electrical or Mining Engineering courses.

No attempt is made to teach trades or to manufacture goods for the market.

COURSES.

First Year.—Drawing; Lettering, Problems in Plane Geometry, Free-hand Sketching, Shop Drawings.

Shop Work: Materials, timber, structure, seasoning, shrinkage, etc. Care and use of wood working tools, marquetry, scroll sawing, glueing, wood carving, wood turning.

Second Year.—Drawing; 3rd Angle Method, Working Drawings and Free-hand Sketching.

Shop Work: Carpentry, joints, flooring, roofs, stairs, doors, standing finish, windows.

Third Year.—Drawing; Architectual and Ornamental Iron Work. Technical Drawing.

Shop Work: Forging, material, properties and inspection of wrought iron and steel. Tools operations, fastenings ornamental work. making of tools.

Fourth and Fifth Years.—Pattern Making Bench and Machine Work in Iron. Machine Design.

FUTURE PLAND AND REQUIREMENTS.

The building is commodious, substantial and comfortable. It is hoped that funds for beautifying the interior may be available from time to time.

It is proposed to extend the system of steam heating used now in the draughting room, over the entire shop, employing the exhaust steam which would otherwise be wasted.

The Draughting Room and Wood Working Shops are the only divisions in operation at the present time. It is

expected that the forge shop will be in running order by January 1st, 1901, and the machine shop by September, 1901. In the meantime several thousand dollars saved from the Morrill Fund will be used in the purchase of machines for the complete equipment of the machine shop.

Very respectfully,

D. H. HOLMES,

Instructor in Manual Training.

Tucson, Arizona,

December 5th, 1900.

Report of Geological Department.

BY THE PROFESSOR OF GEOLOGY.

PROF. M. M. PARKER,
President of the University of Arizona.

DEAR SIR:—I have the honor to submit my report as Professor of Geology for the year 1900.

The instruction in Geology is given chiefly by lectures illustrated by the suites of rocks and fossils in the Museum, by maps, photographs, models, and by drawings at the blackboard.

The subject has been divided in treatment as follows:

I. Astronomical Introduction.—A series of lectures upon the solar and stellar systems.

II. Dynamical Geology.

III. Historical Geology.

IV. Economic Geology.—Comprising the phenomena of mineral deposits and mineral veins.

In addition a series of lectures was given upon mining and mining machinery and upon the mechanical treatment of ore.

An excursion was made into the field with the students to the locality of Devonian corals and other fossils at the

northeast end of the Santa Catalina Mountains.

Considerable attention has been given to the collection of specimens of rocks, minerals and fossils for the Museum, and progress has been made in the classifying and labelling of the specimens already in the cases.

Several excursions to the mountain ranges around us, notably to the Santa Ritas, the Huachucas, Chiricahuas and the Catalinas, and last October to the Grand Canyon of the Colorado, have given greater knowledge of the geologic structure of Arizona, have permitted the collection of valuable specimens for the museum, and have been fruitful in results of educational value to the students, both of Geology and of Mining and Metallurgy.

The addition of a first class microscope to the apparatus of investigation and instruction has been gratefully received. May I be permitted to hope that during the coming year we may have a stereoptican for the more complete and effective illustration of lectures.

Permit me to thank yourself and the Board of Regents for the uniform kindness and consideration I have received.

With great respect, truly yours,

WM. P. BLAKE.

Report of the Operations

OF THE

Arizona School of Mines for the Years 1897, 1898, 1899 and 1900.

Tucson, Arizona, Dec. 15, 1900.

To Professor M. M. PARKER,
President of the University of Arizona.

Sir:—I have the honor to submit my report of the work of the School of Mines of the University of Arizona for the year 1897, 1898, 1899 and 1900 to December 15th, covering the period since my last formal report of January 12, 1897.

Respectfully yours,

WM. P. BLAKE, Director.

REPORT.

The work of the School of Mines may be conveniently considered under six chief headings or divisions:

I. Instructions.
II. Investigation.
III. Testing and Assaying.
IV. Mill Work and Metallurgy.
V. Correspondence.
VI. Museum.

I. INSTRUCTIONS.

The regular four year's course students in the Engineering and Mining course, especially those who take the mining course, are carefully instructed in general and analytical chemistry by Prof. Guild and have the benefit of the two laboratories. After completing the study of quantitive analysis and wet assaying, they are instructed in the theory and practice of assaying. Prof. Guild also gives a full course of instruction in mineralogy and determinative mineralogy, the use of the blow-pipe, etc.

Instruction in physiographic, structural, dynamic and historical geology is given by Prof. Blake, with a short introductory course upon astronomy. After the completion of the lectures upon geology, the characteristics of mineral deposits, lodes, veins, etc., are considered and illustrated by prominent examples. Mining and mining machinery and mill work then receive attention, and are illustrated as far as possible by excursions to the great mines and smelting works of southern Arizona. Thus, during the winter term of the present year, 1900, during the Thanksgiving vacation, the special students in mining and assaying were, by the generous courtesy of the Copper Queen Mining Company, en-

abled to visit the mine and smelters at Bisbee, with free transportation from Benson and return.

SPECIAL SHORT COURSE OF INSTRUCTION IN ASSAYING AND MINING.

In order to meet the needs of young men who are desirous of learning the art of assaying the common ores and metals, and who are not able to give the time required in the full course of study for graduation and the degree of mining engineer, the Board of Regents, in September, 1897, approved of a short course of instruction in practical assaying, metallurgy, etc., to be given in the laboratories and mill of the Arizona School of Mines.

This course commences with the first college term in each year and requires at least two years of time, but students are advised to take the full regular course in engineering and mining, if possible, since in two years they cannot expect more than to make a begining of study in these subjects.

The lectures in the regular courses of study upon Chemistry, Mineralogy, Geology and Metallurgy are open to deserving students in the special short course.

Many young men have availed of this oportunity, to get a partial education in mining and assaying. They are enrolled as special students.

The number for the past four years, in addition to the regular four years course students, has been as follows:

1896-97.....12	1898-99.....6
1897-98.....14	1899-00.....7

Every worthy student in the regular course in mining, as also those in the special short, who have shown sufficient proficiency and ability, have secured positions as assayers or mine superintendents at good salaries. In their respective positions they have been able to promote and advance accu-

rate knowledge of the nature and value of the mineral resources of the Territory. They become diffusers of knowledge and thus add to the general educational advancement of the community, and are thus concrete realizations of the beneficial purpose of the distinguished founder of the Morrill Fund.

II. INVESTIGATION.

The immediate need of the people have given direction to this branch of the work of the school. Questions concerning the underground flow of water and the possibility of obtaining water by boring have been pressed upon the attention of the Director, and have been investigated.

In the month of May, 1898, at the request of Hon. A. P. Shewman, Superintendent of Public Instruction, and other citizens of Mesa, I visited Mesa City and made an inspection of the country lying east and south of that city in the Salt river and Gila valleys, with reference to the possibility of obtaining water for irrigation purpose by means of artesian wells or deep borings. The ideal typical artesian conditions are not found to exist in the Salt River valley, and the conclusion was not favorable to the hope of securing overflowing wells. But it was thought probably that large supplies of water could be reached by boring and pumping, especially along the lower parts of the valley in the trough bottom land of the streams.

The feasibility of effecting a satisfactory separation of the wolframite of the newly discovered deposits at Russellville was demonstrated by the experimental trials at the mill, more particularly described under the head of "Mill Work." Chemical investigations of the exact nature of this ore were carried on at the same time Quantitive analyses were made showing that the mineral was closely allied to the Hubnerite variety of the species, most of the time being

replaced by manganese in combination. Many samples from different parts of the Territory have since been investigated and the presence of this peculiar and hitherto rare mineral has been shown in many remote points, giving reason to believe that it may be found along the Archaen central granite belt from Mexico to Osceola in Utah.

Quantitive analyses of the Hubnerite (wolframite) of the Dragoon locality were made by Mr. Charles P. Richmond, who was graduated in the full mining course in 1899.

The occurrence of the rare metal platinum having been reported from the vicinity of the Great Canyon of the Colorado, and inquiries regarding this discovery having been received from the east, a set of authenticated samples from the so-called platinum beds was obtained and the samples were carefully examined in the laboratory without finding a trace of metals. This result was communicated to the public through the columns of the Phoenix Republican.

The Director having received from the territory the complimentary appointment of Territorial Geologist, without pay, has been called on to make a report annually upon the progress and condition of the mining industry of the territory. Four such reports have been made and have appeared in the annual report of the Governor to the Secretary of the Interior for the year.

Samples of the newly found petroleum in the northern and central part of the territory are now under investigation.

In the Spring Term of 1899, the class in Geology and several of the special students with the Director, made field excursions to the place of discovery of Devonian finds and corals at the northeast end of the Catalina mountains and assisted in measuring the thickness of the outcropping beds.

Other excursions have been made to the foothills of the Santa Catalina range north of Tucson, where the Archaean Gneiss is largely developed.

III. TESTING AND ASSAYING.

In order to promote knowledge of the varied resources of the territory and to meet the demand from many of the prospectors and citizens for information regarding the nature and value of many of the obscure and little known minerals of the territory, the School of Mines invites prospectors and others to send such minerals to the School, where they are carefully examined and reported upon without charge. Such examinations and tests are known as qualitative in distinction from the quantitative determination, or assays, by which not only the nature of the substance is ascertained, but the weight, quantity and value of its parts are determined and made known. The qualitative examination is made by chemicals and other physical tests. The results are carefully recorded and reported. The register kept of both the quantitave and qualitative tests, shows over two hundred and fifty entries during the year 1896, or from No. 484 to 734. In 1897 there were 704 entries, from No. 735 to No. 1439; in 1898, 1030 entries, or from No. 1440 to No. 2470, and at the end of November, 1900, the number of entries had reached the total figure of 4025. Under many of these separate entries from two to forty samples were included.

Since the first of January, 1900, the extent and nature of the work in the department of commercial assaying is shown by the following tabular statement, which is a fair index of the work in previous years:

NUMBER AND NATURE OF ASSAYS AND TESTS.—1900.

1900.	Fire Assays.	Wet Assays.	Analyses.	Qualitative.	Cyanide.
Jan.	108	51	1	33	1
Feb.	90	53		24	
March	107	66		32	3
April	62	23		29	
May	52	34	2	38	
June	34	31		10	
July	38	13		16	
August	42	26		15	
Sept.	36	22	3	10	1
October	66	32	1	27	
Nov.	59	26	1	15	
Dec.	82	22	1	6	
Totals Dec, 15.	776	399	9	255	5

The increase of work in the assay laboratory and its commercial or mining importance rendered the employment of a trained and skillful assayer necessary. In June, 1867, Mr. Mark Walker, a graduate of the University, was selected for this position. In addition to his qualifications as an assayer, he had for years been the chemical assistant of Prof. Forbes of the United States Agricultural Experiment Station, and had become expert in the analyses of mineral waters and other complex substances.

In May, 1900, at the earnest solicitation of the Exposed Reef Mining Company, Mr. Walker was granted a leave of absence for a year, so as to assist that company in the planning and construction of a large cyanide plant in the Huachuca Mountains, where he now is. In the interim Mr. J. S. Mann, a graduate of the John B. Stetson University, Florida, with a year's experience in commercial analysis and a year's special training in the University of Chicago,

has discharged the duties of assayer in an acceptable manner.

The increase of business also required more room, larger furnaces and better facilities.

In 1899 a new assay laboratory was erected upon plans drawn by the Director, giving a large furnace room, receiving room for samples, a room for parting chemical tests and trituration methods and a separate balance room, all well lighted and ventilated. The furnace of brick and constructed to use coke, has two 10x16 mufflers side by side, so managed as to secure a steady, uniform heat and the best results in cupellation. There is also a large furnace for crucible assays and for bullion melting. The whole constitutes a compact but complete assay laboratory much needed for accurate commercial work and as an object lesson to the students of fire assaying.

In making the assays extreme accuracy is counted of first importance, regardless of the cost of the fluxes and methods used. Each sample is assayed in duplicate, and it the results do not correspond, the work is repeated. Check assays of the nuxes alone are made from time to time to guard against any error from the possible presence of silver in the fluxes.

The receipts for assaying have been for each year, from 1895 to 1900 inclusive, as follows:

1895	$ 71 05
1896	368 51
1897	1,064 65
1898	2,795 11
1899	1,958 45
1900	1,107 01

These receipts barely cover the salary of the assayer and the cost of the fuel and fluxes.

In accordance with the legislative enactment, approved March 3d, 1899, the rates for assaying heretofore in force under the law of March, 1897, were changed. The fifty cent rate is no longer in force. Former circulars and schedules of rates were revoked and withdrawn. Under the provisions of the new law, the Regents of the University of Arizona established the following rates for assaying ores taken from deposits and mines in the Territory of Arizona:

Silver and gold, or either,	$1 00
Silver, gold and copper,	2 00
Copper,	1 00
Lead,	1 00
Zinc,	1 00
Iron,	1 00
Gold, silver, copper and lead,	2 50
Gold, silver, copper and iron,	2 50
Gold, silver, copper and zinc,	2 50

IV. MILL WORK AND METALLURGY.

The substance of the former report upon the mlll work may be repeated here.

The demand for mill tests is increasing as the facilities offered by the school are better known. For small lots of from 500 pounds to 2,000 pounds the small or three stamp mill is used, while for larger lots the five stamp mill is best adapted.

Several lots of ore, of 100 to 300 pounds each, have also been sampled so as to get a better and general average for assay.

A great need of this department is floor covering of steel plates, upon which to spread and quarter down the samples.

We also need the addition of concentrating tables of the latest and most approved construction, and many of the

adjuncts of modern gold and silver mills.

As there is no fund upon which to draw for the expenses of running the mill it has been necessary to depend upon custom work. This has been sufficient for a greater part of the time, or sufficient to give all the students an opportunity to see the mill in operation occasionally.

Concentration by jigging was admirably shown by the run upon four carloads of crude wolframite ore from the Dragoon mountains, near Russellville. The separation from the white quartz was very satisfactory and gave a clean product containing over 60 per cent. tungstic acid. The course white quartz separated as tailings, made excellent covering for the roads and walks about the University.

In my report for the year 1896, I stated that the "Cyanide process has also engaged the attention of the School, and many laboratory tests on a small scale have been successfully made. The extraction has been carried to a high degree and the results generally have been so encouraging with many of the Arizona gold ores as to justify the belief that the process will in the near future become generally used."

This anticipation has been fully verified. Several of the young men who have gone out from the Mining School, are now actively engaged in working the piles of tailings from gold mills and in one or two cases the ores are worked direct, without previous removal of the bulk of the gold by amalgamation.

The foundation of the framework supporting the line and counter shafting of the mill have decayed to such an extent as to throw the pulleys out of line and extensive repairs are necessary.

The removal of the mill to some convenient site directly upon the line of the railway is advised. The machinery is now much crowded and the noise of the stamp and machin-

ery when in motion is distracting to the teachers and students in other departments. If erected upon the side of the railway, and equipped as a modern sampling mill with suitable floors and machinery, there is little doubt that it would be largely useful to the prospectors of the territory, and that it would, to a great extent, be self-sustaining. At present the cost of taking ores from the railway out to the mill is one dollar per ton, which is a burden to the prospector, and often when added to the freight is prohibitory.

V. CORRESPONDENCE.

The correspondence of the School is voluminous. Enquiries are received by post from all parts of the United States seeking information regarding the School, its courses of instruction, special studies and requirements.

Enigmatical ores and minerals of doubtful or obscure composition are also sent from all parts of the territory and many are received for qualitative tests or classification from other places. This is especially so since the discovery of wolframite and since other rare metals and minerals have been in demand. Information is sought for and full explanations by mail are desired and are given. There are also many letters received by the Director asking for information regarding the resourses of the territory, and particularly for printed reports and reliable statements regarding its geology and mineralogy, for lists of mills in operation and for information regarding the mines and metallurgical works.

In conjunction with directors of other mining schools, and the friends of mining schools generally, there has been some correspondence seeking to obtain from Congress legislation in favor of mining education equivalent to that now favoring schools of agriculture. It is urged that with a mineral production of nine hundred millions of dollars in value

annually, a large part of which is drawn from the undeveloped wealth of the territories, and the greater need of science in instruction in mining and metallurgy, the people generally should favor the support of schools of mining as they now favor those of agriculture. Such assistance and support is especially required in the Territory of Arizona, where the mining interests are paramount, and lie largely at the foundation of the success and support of agriculture, by affording a home market for its productions.

It is hoped that the attention of the Territorial Legislature may be secured and that united official action may be had in favor of the consummation of the necessary legislation by Congress. In regard to this legislation, the report of Senator Tillman from the Committee on Mines and Mining, says:

"This proposed action is, in fact, merely supplementary to the line of Congressional legislation respecting the use of the public lands for educational purposes for the last forty years. It is in no sense legislation for a particular class. It looks towards the development of resources which effect our national well-being and the betterment of the entire population."

"Several of the land grant institutions have undertaken to maintain departments of instruction in mining, but the increased demands upon them, caused by the rapid advance in every department of modern research and activity, has been far beyond their resources. Even in cases where it has been possible to provide instructions in many of the branches of knowledge related to mining, it has not been possible to provide the apparatus and equipment necessary for research and experiment and there is every reason to believe that the same methods which have in recent years produced so fruitful results in the field of agricultural experiment and inves-

tigation will be found equally productive when applied to the development of our untold mineral wealth."

VI. MUSEUM.

The collection of ores, rocks minerals and fossils, which at the beginning of the year 1895 were somewhat irregularly distributed in different rooms of the building, were, after the completion of the dormitory, placed together in the large room in the Mining School building, formerly occupied in party by the library. New cases have been added by Mr. Herbert Brown, and his splendid collection of birds of Arizona is now effectively displayed and is a very attractive feature of the museum.

There have been many additions each year to the collection of ores, rocks and minerals, all of them important and invaluable, as illustrating the geology and mineral resources of the Territory and indispensable also for illustration of the lectures on geology and mineralogy.

Amongst some of the more notable additions of fossils, the skull of an elephant sent from Yuma by Hon. Herbert Brown, should be mentioned. It was found there in the ancient alluvions of the Colorado. Mr. Brown has also sent other bones, which await determination, especially a remarkable portion of a cranium of some large animal.

A collection of Devonian corals and shells from the Catalinas and from Greaterville, has been added by the director. The horn cores of a species of bos from the auriferous gravels of Greaterville, Pima County, show the former presence in our mountains and valleys of an animal far larger than any bovine now known to us.

The cases in the museum are now filled to overflowing and recourse has been had to wooden trays, which are also filled.

An effort has been made to properly number and record each specimen as received. Hundreds of specimens have been numbered by the Director with the serial number of the general register and temporary labels have been written, but much work is required to label all the specimens and to properly classify them.

It is painfully evident that this now important and highly valuable collection should not be left in any building which is not fire proof. A thoroughly fire proof structure of ample size and simple construction is demanded. It need not be a costly building. The floor should be of cement. The collection is interesting to the general public and affords not only pleasure but instruction to many visitors. It is invaluable. Specimens gathered at great pains and expense are here brought together and cannot be duplicated. Money could not replace them. It is our duty to preserve and care for such collections, and means should be provided for the proper classification, labelling, recording and description of the specimens. I respectfully urge upon you and the Board of Regents, and through you upon our Legislature, the need of a fire proof museum building for the proper display and preservation of the specimens in all departments of geology, mineralogy, mining, ornithology, botany and archaeology.

The thanks of the institution are due to each contributor of specimens by which the museum is enriched and made more useful to the people of the Territory.

WM. P. BLAKE.

The Agricultural Experiment Station.

During the current year the Agricultural Experiment station has continued and strengthened its work in the department of Agriculture and Horticulture, Botany and Chemistry, and established a new department of Animal Husbandry; has distributed an increasing number of publications, both practical and scientific in nature; has engaged in co-operative work with the farmers of the Territory, and with outside specialists; and all things taken together has put in operation a plan of work which has proved to be productive of satisfactory results in a somewhat dispersed situation. The working principle of the present station organization is, so far as possible, to do each kind of work in the situation most favorable to its accomplishment. Upon this principle the Director's office, and the botanical and chemical laboratories have continued and enlarged their operations at Tucson, in connection with the University; the experiment station farm has been increased and the new department of Animal Husbandry has been added at Phoenix; the date palm orchard has been improved and planted in suitable

alkaline lands south of Tempe, and co-operative work has been prosecuted in various parts of the Territory.

The Department of Botany, after the departure of Prof. Toumey, was taken in charge by Mr. David Griffiths, and its operations extended in co-operation with the Division of Agrostology, U. S. D. A. This co-operative work is in the nature of a study of range conditions in the arid southwest, with a view to acquiring a knowledge of ways and means for the improvement and administration of large areas of range country. It is a matter of common knowledge that the overstocking of the range in many districts, has practically destroyed the country for grazing purposes. The grasses have been killed out and the seed blown or washed away, while in many localities the bared and devastated surface has begun to wash and gully in a disastrous manner. This condition is not only ruinous to stock men, but also to the irrigation farmers, who are affected by the alternating floods and droughts caused by a bare watershed. The study of the conditions which lead to these results has now been definitely entered upon by the Arizona station. Three hundred and fifty acres of worn out range land in the vicinity of Tucson has been fenced, native grass seed has been secured and the study of the economic reclamation of this experimental tract has been begun. When through this means, definite knowledge of the principles of range improvement and administration shall have been acquired, it will be possible to advise intelligently upon the subject of range improvement. At present much confusion necessarily results from a discussion of this subject for the simple reason that adequate scientific knowledge upon it does not exist, and the first step towards the solution of questions relating to range improvement is to obtain that scientific knowledge which the Station has set about to secure. In addition to this major line of

work, Dr. Griffiths has also taken up the study of economic cacti, and of fungus diseases injurious to important crop plants in Arizona.

The Department of Chemistry during the past year has been chiefly busy with the examination of the principal irrigation waters of the territory. The future of any irrigated district is largely dependent upon the quality of the irrigating waters available. A water containing small quantities of alkaline salts will have no deleterious effects upon the fields to which it is applied. When, however, from any cause, an irrigating water is charged with soluble salts of harmful nature, these tend to accumulate on irrigated lands, and in time their presence will seriously menace the agriculture of a given district. Lands which, therefore, at the beginning of operations were productive, may afterwards be abandoned because of the gradual increase of deadly alkaline salts. Consequently, prospective investors under a given irrigating water supply would be greatly enlightened as to the probable future of their holdings by a reliable knowledge of the quality and probable effect of their water supply. With this end in view, the station has, during the past year, collected daily samples from the Salt river at Mesa, the Gila river at Florence, and the Colorado river at Yuma. The results thus far indicate that for the most part these leading irrigating streams are of satisfactory quality, but fluctuations are observed at different times of the year, and at different parts even of the same stream, a knowledge of which should be of local value along the lines mentioned above. Of particular interest is the knowledge founded upon this work of the amount of fertilizing silts which are brought down by the irrigating waters. The figures for one year's water supply in the Salt river valley indicate that a sufficent supply of

nitrogen, for instance, is each year distributed by the irrigating water to mature at least a two ton crop of barley hay, a ten ton crop of sugar beets, or a fifty bushel crop of wheat. These investigations, involving a great amount of technical work are not yet completed, but the matured results are expected in the course of a few months. Much other miscellaneous work has also been transacted by the Department of Chemistry during the year.

The Department of Agriculture and Horticulture, in charge of Prof. A. J. McClatchie, has continued with its significant and growingly useful work during the year. The study of the methods of culture of the various common garden vegetables has proven not only useful to the many small farmers, part of whose living must come from their gardens, but has also in this region proved an interesting subject of investigation. The two temperate seasons in the spring and fall of the year respectfully, together with the mild winter, lead in many instances to a repetition of the growing season for garden vegetables, while the hot, dry summer introduces a new range of plants, but little known in more temperate and humid regions.

The investigations of this department with green manuring plants is also significant in connection with the humus and nitrogendeficient soils of the arid Southwest. A knowledge of the leguminous green manuring plants is gradually being worked out, which will satisfy the greatest possible range of conditions of this region.

Experimental work has been carried on during the year to test different varieties of wheat, barley, sorghum, and forage plants in general.

The testing of various species of eucalypti has already

developed certain varieties which may be grown to advantage in Salt river valley, notably: E. corynocalyx, E. cornuta, E. hemiphloia, E. leucoxylon, E. Melliodora, E. polyanthema, and E. rostrata, useful for fence posts, fuel, ties, timbers, and as a source of honey. This is a matter of great significance in a region so particularly in need of timber and fence post trees, which may be grow along the banks of the irrigating ditches.

Of particular significance also is Prof. McClathie's work the winter irrigation of orchards. In the winter, when irrigation water is more abundant under the Salt and Gila rivers, it has been found that in many localities the soil can be filled with irrigating water to a depth of many feet. The soil is thus made to act as a reservoir for the benefit of orchard trees and other deep rooted plants. By cultivating the surface of a deeply irrigated soil, and restricting evaporations the supply may be economized to such an extent that on the experiment station farm, for instance, the trees bore heavy crops of fruit and made a strong growth of new wood, without irrigating during a summer season when many old, established orchards in Salt river valley suffered severely or actually perished for want of water.

The newly established department of Animal Husbandry, under the care of Professor Gordon H. True, has begun work which is already proving significant and helpful to the stock feeding and dairy interests of irrigated districts. In order that Professor True might have sufficient room in which to prosecute his experimental work, the Station bought the Renaud property of twenty-eight acres, adjoining the experiment station farm, employing for that purpose accumulated laboratary fees, and the proceeds of green house and farm produce sales.

During the year experimental work has been conducted in the fattening of sheep and steers. A dairy herd has been started, and in co-operation with the various herd owners of the valley, observations have been conducted on the profitableness of the various individuals in dairy herds in such a way as to point out the means by which a given herd can be brought to the highest degree of profitableness.

The date palm orchard south of Tempe has been improved and extensive plantings made therein during the year. The small preliminary shipment of foreign suckers in 1899 was followed by a large shipment of some 445 suckers from Algiers in the summer of 1900. This shipment was made through the efforts of Mr. W. T. Swingle of the U. S. D. A., who went to the Sahara Desert and personally selected and shipped the consignment. Through his efforts, and also through the energetic and courteous arrangements of the Southern Pacific Company, the suckers arrived at Tempe in a remarkably short time, and were duly installed in their new home. The shipment was made from Algiers on June 11th, arrived at Tempe on July 17th, was planted on July 20th to 23rd, and was watered and cared for daily during the ensuing critical period of two months. An inspection on October 2nd, 1900, showed that 93 per cent. of the palms were apparently safe, many of them actually having commenced to grow.

The present outlook in the date palm orchard is very favorable and it is hoped that a successful demonstration of this branch of horticulture in the alkaline lands of Southern Arizona will create a use for tens of thousands of acres of alkaline lands in the arid southwest.

During the year, also, the experimental work with sugar beets was extended to the upper Gila, under the special care

of Mr. Arney of the experiment station. The season was very adverse, the unusual shortage of water bringing some of the experiments to an untimely end. A sufficient number of beet plots, however, was carried through to yield encouraging results. It is planned to continue this work another year, when a still more favorable outcome is to be hoped for. The proximity of artesian water of good quality, of limestone and possibly also coal would indicate the upper Gila valley as the most feasible site for a beet sugar factory in Arizona. Consequently, it is intended that the experimental work with sugar beets on the upper Gila shall be persisted in.

The co-operative work of the year with the special agents of the U. S. D. A. has been productive of excellent results. The Division of Soils, at the invitation of the Station, entered into a co-operative working arrangement whereby a survey was made of Salt River Valley, showing the distribution of the various soil types, and the amount and nature of alkaline salts in the soil. This survey for the first time puts definite information in the hands of prospective investors in this district, and when published should be an important guide to purchasing settlers.

The Director's office during the year has endeavored to increase the usefulness of the Station by purchasing and distributing useful information, both scientifical and practical in nature, to the farmers of the Territory. Five regular bulletins and an annual report have been published. The bulletins treated the subjects of sugar beets, insect pests, the crown-gall disease of deciduous fruit trees, vegetable growing in Southern Arizona, and a collection of timely articles on subjects of current interest, entitled, "Timely Hints for Farmers." These "Hints" were published twice a month and distributed to all the names on our Southwestern

mailing list—some 2,500 in number. This involved the distribution of not less than 43,000 pieces of mail during the year, but the efforts has been well received by an appreciative farming public.

Acknowledgments are due to the many friends of the Station who, during the year, have promoted and guided its efforts. The governing board has at all times manifested a helpful influence upon its operations and the attitude of the University management has been most friendly; the railroads, especially the Southern Pacific Company, have been most accommodating in matters of transportation, and the correspondence of the Station has been full of expressions of appreciation from the farmers; which have done much to help it on.

With a logical and successful organization, with each Department busy with its special lines of investigation, with growing interest and appreciation on the part of the agricultural public, it is hoped that the Arizona Experiment Station has at last reached a condition of quiet and stability.

Following is a financial statement for the fiscal year ending June 30, 1900.

R. H. FORBES, Director and Chemist.

THE LIBRARY OF THE
APR 15 1931
UNIVERSITY OF ILLINOIS

UNIVERSITY OF ARIZONA AGRICULTURAL EXPERIMENT STATION,

In account with

THE UNITED STATES APPROPRIATION, 1899-1900.

DR.

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1900, as per Act of Congress, approved March 2, 1897..... $15,000 00

CR.

	Abstract.		
By Salaries.....	1	.....	6,947 73
Labor	2	.....	3,525 15
Publication	3	.....	870 32
Postage and Stationery,...	4	.....	204 72
Freight and Express,.....	5	.....	348 08
Heat, Light and Water,...	6	.....	108 90
Chemical Supplies, ...	7	.....	127 85
Seeds, Plants and Sundry Supplies, ...	8	.....	211 46
Fertilizers,.....	9	.....	208 65
Feeding Stuffs,.....	10	.....	190 31
Library,.....	11	.....	7 97
Tools, Implements and Machinery.....	12	.....	708 58
Furniture and Fixings,....	13	.....	23 25
Scientific Apparatus,.....	14	.....	103 93
Live Stock,..	15	.....	410 00
Travelling Expenses,.....	16	.....	599 50
Contingent Expenses,.....	17	.....	10 30
Building and Repairs,..... ...	18	.....	393 30
Total,.....			$15,000 00

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